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What They Do

Industrial Engineers combine solid engineering background with effective business management practices to improve quality and efficiency. Industrial Engineers recommend the best use of facilities, equipment, material, and people to make or process a product at lower cost, faster, and better. They look at the total operations process to improve work environment and safety. Industrial Engineers also concern themselves with office automation, cost-containment, and consolidation efforts.

Industrial Engineers may specialize in information technology, information systems and design, material management, logistics and distribution, plant layout and design, production planning, or work methods analysis. Industrial Engineers' job titles reflect the range of their assignments: business process engineer, manufacturing engineer, operations engineer, facilities engineer, plant engineer, quality engineer, reliability engineer, productivity engineer, systems engineer, ergonomist, and management engineer. Industrial Engineers work in manufacturing, government, hospitals, food processing, transportation, retail, amusement parks, and large business organizations.

Industrial Engineers who specialize in production planning determine how much a plant can produce. They depend upon computers, CAD/CAM (computer-aided design and computer-aided manufacturing) software and computer simulation to figure out the best methods for production, distribution, equipment, and transportation. They may also be responsible for quality control and inventory. They consider handling and storage of incoming material, and set inventory size, as well as packaging and shipping methods.

Tasks

Operations

- ▶ Review schedules or forecasts, specifications, and customer requirements to understand what activities, and in what order, things should be done.
- ▶ Develop methods, labor utilization standards, and cost analysis systems for efficient staff and facility operation.
- ▶ Monitor workflow schedules according to established best practices to come up with improved cycle time.
- ▶ Study operations sequence, material flow, functional statements, organization charts, and project information to determine systems (labor, tools, computers) design and workplace layout.

Industrial Engineers

- ▶ Apply statistical methods to determine processes, staff requirements, and production standards.
- ▶ Project system deliveries based on marketing forecasts, supply chain design, storage and handling facilities, and maintenance requirements.

Logistics and Distribution (Supply Chain Management)

- ▶ Design methods of transporting goods from one location to another. This could mean locating, designing, and building of warehouses for large national merchandisers so their stores can be stocked on a timely basis. It could mean designing the system of trucks, rail and air to supply parts for assembly or repair (as in the auto industry).
- ▶ Design systems for handling materials from differing transportation modes and redistributing them in a minimum amount of time; for example, long haul trucks, local trucks, air cargo delivery, and containers.
- ▶ Design systems for automated replenishment of stock; such as, scanning a bar coded product in a store triggers a system that orders new stock to be delivered back to that same store.
- ▶ Design systems for the transport of people in a municipal setting, such as rail, bus, and train.
- ▶ With architects, design public facilities, such as parking garages, public transportation stations or centers, for the efficient flow and safety of people.

Facilities Planning

- ▶ Draft and design layout of equipment, materials, and workspace to illustrate maximum efficiency, using drafting tools and computer simulation.
- ▶ Plan and establish sequence of operations to fabricate or assemble parts or products, or service customers, and to promote efficient utilization of resources.

Quality Control

- ▶ Coordinate quality control objectives and activities to resolve production problems, increase product reliability, and minimize cost with partners around the world.
- ▶ Analyze statistical data and product specifications to establish quality and reliability objectives of finished product.
- ▶ Formulate sampling procedures and forms for recording, evaluating, and reporting quality and reliability data.
- ▶ Implement methods for disposition of defective material or parts, and assesses cost and responsibility.
- ▶ Estimate production cost and effect of product design changes for management review, action, and control.
- ▶ Record or oversee recording of information to ensure currency of engineering drawings and documentation of production problems.
- ▶ Direct workers engaged in product measurement, inspection, and testing activities to ensure quality control and reliability.

Detailed descriptions of these occupations may be found in the Occupational Information Network (O*NET) at online.onetcenter.org.

Important Skills, Knowledge, and Abilities

- ▶ Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
- ▶ Active Listening — Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
- ▶ Time Management — Managing one's own time and the time of others.
- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work related documents.
- ▶ Complex Problem Solving — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- ▶ Judgment and Decision Making — Considering the relative costs and benefits of potential actions to choose the most appropriate one.
- ▶ Engineering and Technology — Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- ▶ Production and Processing — Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- ▶ Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- ▶ Administration and Management — Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.
- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ Computers and Electronics — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- ▶ Design — Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- ▶ Deductive Reasoning — The ability to apply general rules to specific problems to produce answers that make sense.
- ▶ Problem Sensitivity — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- ▶ Inductive Reasoning — The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Speech Clarity — The ability to speak clearly so others can understand you.

Industrial Engineers

Work Environment

Industrial engineering is not physically demanding, but frequently takes the Engineer out of the office into production and manufacturing areas. Today, this often means traveling across the country or around the world to the manufacturing site. Industrial Engineers spend much of their time asking questions. They may talk with production workers, as well as technical or administrative staff. It is not unusual for these Engineers to be involved in several projects at once. Therefore, they must be flexible enough to drop one project and pick up another at a moment's notice.

Much of an Industrial Engineer's output is used by management for making decisions. As a result, these workers must be accurate; their recommendations may affect the size of their firm's profits, its labor relations, as well as its productions costs. Because of this, stress may be considerable at times.

Industrial Engineers usually work a 40-hour workweek. However, long or irregular hours may be necessary to meet deadlines or when working on special projects.

California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

Standard Occupational Classification	Estimated Number of Workers 2004	Estimated Number of Workers 2014	Average Annual Openings	2006 Wage Range (per hour)
Industrial Engineers				
17-2112	19,600	24,100	920	\$30.68 to \$46.69

Wages do not reflect self-employment.

Average annual openings include new jobs plus net replacements.

Source: www.labormarketinfo.edd.ca.gov, Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.

Trends

Overall employment of Industrial Engineers, including health and safety, is expected to grow faster than the average for all occupations through 2014. Most opportunities will arise as existing workers retire or leave for other kinds of work. New jobs are expected in computer systems design firms, semiconductor plants, and in temporary employment services companies, where Industrial Engineers may be hired for the duration of a specific project.

Training/Requirements/Apprenticeships

A bachelor's degree in Industrial Engineering or a related engineering degree is almost always necessary for entering this occupation. In addition, many employers will hire only those who have at least two years' successful experience in this field. Eight California universities offer degrees in Industrial Engineering accredited by the Accreditation Board for Engineering and Technology (ABET). Industrial Engineers planning careers in management find that obtaining a master's degree in business administration (MBA) is helpful.

Engineers working for government agencies or whose work may affect the public welfare are required to be registered by the State Board of Professional Engineers and Land Surveyors (See Other Sources of Information). To obtain registration, Engineers must pass the Engineer-in-Training examination, obtain at least two years' engineering experience (without a bachelor's degree in

Industrial Engineering, six years of experience is required), and then pass the professional examination in industrial engineering. While registration is not required for all jobs, a registered Engineer will have a competitive edge for advancement to more responsible positions.

Recommended High School Course Work

High school students should take courses in mathematics and physical, social, and computer sciences to prepare for this career field. They should also develop drafting and drawing skills. Electives in electronics, business administration, and computer science will provide valuable background for a successful career in industrial engineering.

Where Do I Find the Job?

Those still in school can interview with employers recruiting on campus and reply to job advertisements. Engineers may also find work through professional engineering associations, advertisements in newspapers, and professional and trade journals. Recommendations by company employees, contacts with employers, and referrals by the present employer are all common ways to find a position.

Direct application to employers remains one of the most effective job search methods. Use the *Search for Employers by Industry* feature on the *Career Center* page at www.labormarketinfo.edd.ca.gov to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Aircraft
- ▶ Aircraft Engine and Engine Parts
- ▶ Bare Printed Circuit Board
- ▶ Custom Computer Programming Services
- ▶ Electricity & Signal Testing Instruments
- ▶ Electromedical Apparatus
- ▶ Electronic Connector
- ▶ Engineering Services
- ▶ Guided Missiles and Space Vehicles
- ▶ Industrial Process Variable Instruments
- ▶ Other Aircraft Parts and Equipment
- ▶ Other Electronic Component
- ▶ Search, Detection & Navigation Instrument
- ▶ Semiconductor and Related Devices

Search these **yellow page** headings for listings of private firms:

- ▶ Engineers-Consulting
- ▶ Engineers-Environmental
- ▶ Engineers-Industrial
- ▶ Engineers-Manufacturing
- ▶ Engineers-Petroleum
- ▶ Engineers-Pollution Control
- ▶ Engineers-Safety
- ▶ Engineers-Sanitary

Where Can the Job Lead?

As they gain experience, they may advance to associate and senior level positions. From the senior level, Engineers may advance into project management or production supervision. Industrial Engineers planning careers in management find that obtaining a master's degree in business administration (MBA) is particularly helpful. Industrial engineering education and experience is a solid background for advancement in many kinds of work. Many top level managers and executives across many industries have an industrial engineering background.

Industrial Engineers

Other Sources of Information

California Board for Professional Engineers and Land Surveyors
www.dca.ca.gov/pels

Institute of Industrial Engineers
www.iienet.org

The American Society of Safety Engineers
www.asse.org

Board of Certified Safety Professionals
www.bcsp.org

Manufacturing Careers